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**Technology Center 2100**

**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/627,385  
Filing Date: July 25, 2003  
Appellant(s): RAO ET AL.

Marc R. Ascolese (Reg. No. 42,268)  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed October 19, 2006 appealing from the Office action mailed April 24, 2006.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

Frank et al, US Patent No. 6,532,494 filed on May 28, 1999.

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-31 are rejected under 35 U.S.C. 102(e) as being anticipated by Frank et al, (hereinafter referred to as "Frank") U.S. Patent No. 6,532,494.

1. As per claim 1, Frank teaches a method comprising:

providing a coordinator virtual device corresponding to at least a portion of a physical data storage device (*abstract, col. 1 lines 30-40, col. 3 lines 34-45; shareable storage equated as "coordinator virtual device"*);

detecting when a computer system cluster, including a plurality of nodes, is partitioned  
(*col.9 lines 51-61, col. 2 lines 5-15*);

attempting to gain control of the coordinator virtual device (*col. 3 lines 35-45, col. 5 lines 7-60, col. 8 lines 43-48; each node sends a heartbeat message to other nodes to identify its status*);  
and

removing at least one of the plurality of nodes from the computer system cluster when the attempting is unsuccessful (*col. 5 lines 7-60, col. 10 lines 10-15; if a node fails to receive a heartbeat message, then cluster enters a reconfiguration mode to remove unresponsive node from cluster*).

2. As per claim 2, Frank teaches the method wherein the providing a coordinator virtual device corresponding to at least a portion of a physical data storage device further comprises:

selecting the at least a portion of a physical data storage device (*col. 3 lines 1-20*);

associating a physical description of the at least a portion of a physical data storage device with a coordinator virtual device identifier (*col. 3 lines 35-45, col. 6 lines 34-40*); and

allowing at least one of the plurality of nodes of the computer cluster to access the at least a portion of a physical data storage device via the coordinator virtual device identifier (*col. 3 lines 35-45, col. 6 lines 34-40*).

3. As per claim 3, Frank teaches the method wherein the providing a coordinator virtual device corresponding to at least a portion of a physical data storage device is performed by at least one virtual device configuration server (*col. 3 lines 1-20, col. 4 lines 32-43*).

4. As per claim 4, Frank teaches the method wherein the at least one virtual device configuration server is separate from the plurality of nodes of the computer cluster and wherein at least one of the plurality of nodes of the computer cluster further comprises a virtual device configuration client (*col. 4 lines 7-35*).

5. As per claim 5, Frank teaches the method further comprising:

reading cluster membership information from the coordinator virtual device corresponding to at least a portion of a physical data storage device (*col. 2 lines 61-62, Fig. 6 element 88*).

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6. As per claim 6, Frank teaches the method wherein the detecting when a computer system cluster, including a plurality of nodes, is partitioned (**col. 9 lines 51-62**) further comprising:

reading, as performed by one of the plurality of nodes, cluster membership information from the coordinator virtual device corresponding to at least a portion of a physical data storage device (**col. 2 lines 61-62, Fig. 6 element 88**); and

determining whether the cluster membership information indicates that the one of the plurality of nodes is a current member of the computer system cluster (**col. 3 lines 66-67, col. 4 lines 1-6, col. 5 lines 1-5**).

7. As per claim 7, Frank teaches the method further comprising:

writing cluster membership information to the coordinator virtual device corresponding to at least a portion of a physical data storage device (**col. 6 lines 14-28**).

8. As per claim 8, Frank teaches the method of wherein the coordinator virtual device corresponding to at least a portion of a physical data storage device further comprises cluster membership information (**col. 3 lines 37-57**).

9. As per claim 9, Frank teaches the method wherein the coordinator virtual device corresponding to at least a portion of a physical data storage device is a coordinator volume (**Fig. 1 element 22, col. 3 lines 1-10**).

10. As per claim 10, Frank teaches the method wherein the detecting when a computer system cluster, including a plurality of nodes, is partitioned further comprises:

monitoring a network coupled to each of the plurality of nodes for a heartbeat signal (**col. 4 lines 24-34, col. 6 lines 6-23**); and

determining when the heartbeat signal is not present for a specified period of time (**col. 2 lines 5-34, col. 5 lines 18-23**).

11. As per claim 11, Frank teaches the method further comprising:

retaining the at least one of the plurality of nodes in the computer system cluster when the attempting is successful (**col. 8 lines 48-55**).

12. As per claim 12, Frank teaches the method encoded in a computer readable medium as

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instructions executable on a processor, the computer readable medium being one of an electronic storage medium, a magnetic storage medium, an optical storage medium, and a communications medium conveying signals encoding the instructions (*col. 10 lines 62-67, col. 11 lines 1-4*).

13. As per claim 13, Frank teaches the method further comprising:

allowing at least one of the plurality of nodes of the computer cluster to exclusively access the at least a portion of a physical data storage device (*col. 3 lines 6-44*).

14. As per claim 14, Frank teaches the method further comprising:

obtaining exclusive access to the at least a portion of a physical data storage device (*col. 3 lines 6-44*).

15. As per claim 15, Frank teaches a system comprising:

a first data storage device (*abstract, col.1 lines 30-40, col. 3 lines 34-45*);

a virtual device configuration server coupled to the first storage device and including a first memory and a first processor configured to provide a coordinator virtual device corresponding to at least a portion of the first data storage device (*Fig. 5; col. 7 line 54 to col. 8 line 150; storage device, memory and processor are inherent because they are a major hardware components of a basic computer system*);

a plurality of virtual device configuration clients configured as a computer system cluster, at least one of the plurality of virtual device configuration clients including a second memory and a second processor (*col. 1 lines 30-40*) configured to:

detect when the computer system cluster is partitioned (*col.9 lines 51-61, col. 2 lines 5-15*);

attempt to gain control of the coordinator virtual device corresponding to at least a portion of the first data storage device (*col. 3 lines 35-45, col. 5 lines 7-60, col. 8 lines 43-48; each node sends a heartbeat message to other nodes to identify its status*); and

remove the at least one of the plurality of virtual device configuration clients from the computer system cluster when the attempt to gain control of the coordinator virtual device is unsuccessful

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**(col. 5 lines 7-60, col. 10 lines 10-15; if a node fails to receive a heartbeat message, then cluster enters a reconfiguration mode to remove unresponsive node from cluster ).**

16. As per claim 16, Frank teaches the system wherein virtual device configuration server is further configured to:

select the at least a portion of the first data storage device (**col. 3 lines 1-20**);

store a coordinator virtual device identifier associated with a physical description of the at least a portion of the first data storage device (**col. 3 lines 35-45, col. 6 lines 34-40**); and

allow the at least one of the plurality of virtual device configuration clients to access the at least a portion of the first data storage device via the coordinator virtual device identifier (**col. 3 lines 35-45, col. 6 lines 34-40**).

17. As per claim 17, Frank teaches the first data storage device is at least one of a disk drive, a JBOD, a disk array, and an integrated circuit (**col. 10 lines 64-67**).

18. As per claim 18, Frank teaches the system wherein the first data storage device is coupled to the virtual device configuration server via a network (**col. 11 lines 5-10**).

19. As per claim 19, Frank teaches the system wherein the virtual device configuration server is a volume server, wherein the coordinator virtual device is a coordinator volume, and the plurality of virtual device configuration clients is a plurality of volume clients (**Fig. 1 element 22, col. 3 lines 1-10**).

20. As per claim 20, Frank teaches the system wherein the at least one of the plurality of virtual device configuration clients is further configured to read cluster membership information from the coordinator virtual device corresponding to at least a portion of the first data storage device (**col. 2 lines 61-62, Fig. 6 element 88**).

21. As per claim 21, Frank teaches the system of claim 20 wherein the at least one of the plurality of virtual device configuration clients is further configured to determine whether the cluster membership information indicates that the at least one of the plurality of virtual device configuration clients is a current member of the computer system cluster (**col. 3 lines 66-67, col. 4 lines 1-6, col. 5 lines 1-5**).

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22. As per claim 22, Frank teaches the system wherein the at least one of the plurality of virtual device configuration clients is further configured to write cluster membership information to the coordinator virtual device corresponding to at least a portion of the first data storage device (**col. 6 lines 14-28**).

23. As per claim 23, Frank teaches the system wherein the coordinator virtual device corresponding to at least a portion of the first data storage device further comprises cluster membership information (**col. 3 lines 37-57**).

24. As per claim 24, Frank teaches the system wherein the at least one of the plurality of virtual device configuration clients is further configured to retain the at least one of the plurality of virtual device configuration clients in the computer system cluster when the attempt to gain control of the coordinator virtual device is successful (**col. 8 lines 48-55**).

25. As per claim 25, Frank teaches the system wherein the first memory and the virtual device configuration server belong to at least one of a host computer system, a cluster node, a storage appliance, a network appliance, and a storage area network (SAN) switch (**Fig. 4 element 16, col. 1 lines 30-40, col. 3 lines 34-45, col. 11 lines 5-10**).

26. As per claim 26, Frank teaches the system wherein the at least one of the plurality of virtual device configuration clients is further configured to obtain exclusive access to the coordinator virtual device (**col. 3 lines 6-44**).

27. As per claim 27, Frank teaches the system wherein the virtual device configuration server is further configured to allow exclusive access to the coordinator virtual device by the at least one of the plurality of virtual device configuration clients (**col. 3 lines 6-44**).

28. As per claim 28, Frank teaches an apparatus comprising:

a) a means for providing a coordinator virtual device corresponding to at least a portion of a physical data storage device (**abstract, col.1 lines 30-40, col. 3 lines 34-45**);

b) a means detecting when a computer system cluster, including a plurality of nodes, is partitioned (**col.9 lines 51-61, col. 2 lines 5-15**);



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c) a means for attempting to gain control of the coordinator virtual device (**col. 3 lines 35-45, col. 5 lines 7-60, col. 8 lines 43-48; each node sends a heartbeat message to other nodes to identify its status**); and

d) a means for removing at least one of the plurality of nodes from the computer system cluster when the attempting is unsuccessful (**col. 5 lines 7-60, col. 10 lines 10-15; if a node fails to receive a heartbeat message, then cluster enters a reconfiguration mode to remove unresponsive node from cluster**).

29. As per claim 29, Frank teaches the apparatus further comprising:

a means for reading cluster membership information from the coordinator virtual device corresponding to at least a portion of a physical data storage device (**col. 2 lines 61-62, Fig. 6 element 88**).

30. As per claim 30, Frank teaches the apparatus of claim 28 further comprising:

a means for writing cluster membership information to the coordinator virtual device corresponding to at least a portion of a physical data storage device (**col. 6 lines 14-28**).

31. As per claim 31, Frank teaches the apparatus of claim 28 further comprising:

a means for determining whether cluster membership information stored in the coordinator virtual device corresponding to at least a portion of a physical data storage device indicates that the one of the plurality of nodes is a current member of the computer system cluster (**col. 3 lines 66-67, col. 4 lines 1-6, col. 5 lines 1-5**).

#### **(10) Response to Argument**

Regarding appellant's arguments filed on October 19, 2006, the examiner summarizes the various points raised by the appellant and addresses responses individually.

- A. Appellant argues that Frank fails to teach or suggest providing a coordinator virtual device corresponding to at least a portion of a physical data storage device, detecting when a computer cluster including a plurality of nodes is partitioned, attempting to gain control of the coordinator virtual device and removing at least one of the plurality of nodes from the computer system

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cluster when the attempting is unsuccessful in context of independent claims 1 and 28 (brief page 4 lines 16-23, page 8 lines 14-15).

In response to A) Frank teaches a system including a method and an apparatus for operating a network cluster in a closed loop having a plurality of nodes. Each node sends a single heartbeat message to a node a head of it in the loop and if a node fails to receive a heartbeat message from its predecessor node in the loop, it initiates cluster reconfiguration by sending reconfiguration message to each node in the cluster (summary, col. 2 lines 16-34).

Regarding the limitation "*providing a coordinator virtual device corresponding to at least a portion of a physical data storage device*", Examiner respectively disagrees. Referring to appellant specification and brief, appellant defined *coordinator virtual device* can be formed from one or more portions of physical storage devices such as one or more disk drives (specification, page 12, paragraph [0040]) and (brief page 2 lines 9-14). Frank teaches a shareable storage 22 as a single storage device and may include multiple storage devices (col. 3 lines 34-45, Fig. 1). The shareable storage taught by Frank is equated by the Examiner hereinafter as "*coordinator virtual device*".

Regarding the limitation "*detecting when a computer cluster including a plurality of nodes is partitioned*", Frank teaches nodes in a computer network cluster continually monitor the other nodes in the cluster to know whether another node has ceased operation within the cluster. As a means for monitoring the membership status of the nodes in the cluster, heartbeat messages are sent from each node to each other node in the cluster. If a node failed to receive a heartbeat message from one of the other nodes within a predetermined time interval, the cluster would enter reconfiguration mode. In reconfiguration mode, all user applications executing on the network cluster are stalled until the cluster membership is once again verified (col. 5 lines 6-23). In addition, Frank teaches a process for resolving a partitioned cluster by executing a distributed application on the quorumless cluster 10, which is afforded an opportunity to provide a vote from which it is determined which cluster partition will continue operating (col. 9 line 63 – col. 10 line

2). Therefore, Frank teaches detecting when a computer system cluster including a plurality of nodes is partitioned.

Regarding the limitation "*attempting to gain control of the coordinator virtual device*", Frank teaches upon formation of quorumless cluster 10, one of the member nodes 12, 14, 16 or 18 is designated as the coordinator node. The cluster manager of the coordinator node is responsible for making updates to the cluster definition (col. 7 lines 21-30). For clarification purpose, the coordinator node taught by Frank is a node in a network cluster responsible for making updates to the cluster definition, which is stored in the shareable storage "*coordinator virtual device*". Therefore, Frank teaches attempting to gain control of the coordinator virtual device.

Regarding the limitation "*removing at least one of the plurality of nodes from the computer system cluster when the attempting is unsuccessful*", appellant discloses "Nodes failing to gain control of the coordinator virtual device remove themselves or are removed from the cluster" (specification, page 5, paragraph [0011]). Frank teaches if a node loses access to the shareable storage, it removes itself from the cluster (col. 10 lines 9-15). Therefore, Frank teaches removing at least one of the plurality of nodes from the computer system cluster when the attempting is unsuccessful and meets the scope of the claimed limitations as explained above.

- B. Appellant argues that it is unclear which element in the cited columns and lines equated as "*coordinator virtual device*" (brief page 4 line 27 – page 5 line 10).

In response to B) As previously stated in argument A, the shareable storage 22 (col. 3 lines 34-45) is equated by the Examiner as a "*coordinator virtual device*". It is believed that it is now clear what element in Frank's teaching corresponds to the "*coordinator virtual device*" as recited in the instant application.

- C. Appellant argues that Frank fails to teach or suggest that the shareable storage is a coordinator virtual device and the cluster manager is not a coordinator virtual device (brief page 6 lines 26-31, page 7 lines 18-20).

In response to C) Appellant is reminded that claims must be given their broadest reasonable interpretation. As previously stated in response to argument A and B, referring to appellant specification, appellant defined *coordinator virtual device* can be formed from one or more portions of physical storage devices such as one or more disk drives (specification, page 12, paragraph [0040]). Frank teaches a shareable storage 22 as a single storage device and may include multiple storage devices (col. 3 lines 34-45, Fig. 1). The shareable storage taught by Frank is equated by the Examiner as "*coordinator virtual device*". For clarification, the cluster manager does not correspond to a "*coordinator virtual device*". The cluster manager is a software running in each of network cluster nodes, which manages the cluster connectivity in the computer network cluster (col. 4 lines 32-42, Fig. 2 element 32). Therefore, the shareable storage taught by Frank is the element equated by the Examiner to correspond to the "*coordinator virtual device*".

- D. Appellant argues that there is nothing in Frank teaching or suggesting attempting to gain control of a cluster manager either by a cluster manager itself or any other entity (brief page 7 lines 22-24).

In response to D) The cluster manager taught by Frank does not correspond to "*coordinator virtual device*" as previously explained in response to argument C. It is believed that appellant is referring to the limitation "*attempting to gain control of the coordinator virtual device*" addressed in response to argument A and not "*attempting to gain control of the cluster manager*". Frank teaches upon formation of quorumless cluster 10, one of the member nodes 12, 14, 16 or 18 is designated as the coordinator node (col. 7 lines 21-30). Appellant attention is directed to response to argument A for further details.

- E. Appellant argues that Frank's coordinator node is not a coordinator virtual device (brief page 7 line 25).

In response to E) As previously stated in response to argument A, the coordinator node does not correspond to the "*coordinator virtual device*". The coordinator node taught by Frank is a node in a network cluster responsible for making updates to the cluster definition, which is stored

in the shareable storage "*coordinator virtual device*". However, the coordinator node is the only node within a network cluster having the privilege to update and coordinate the changes to the cluster definition (col. 7 lines 21-30). Appellant attention is directed to Fig. 4 wherein nodes 12, 14 and 18 have limited access to the shareable storage while node 16 (coordinator node) has full access to the shareable storage including log file 54 and cluster definition 48.

- F. Appellant argues that Frank fails to teach or suggest the limitations in independent claim 15 (brief page 8 lines 18-32).

In response to F) Regarding the limitation "*a virtual device configuration server coupled to the first storage device and including a first memory and a first processor configured to provide a coordinator virtual device corresponding to at least a portion of the first data storage device*", Frank discloses a network cluster configuration includes a plurality of nodes interconnected and typically sharing one or more storage devices (col. 1 lines 30-54). Since each node in a network cluster is per se a server servicing one or more clients. Therefore, the teaching of Frank meets the scope of the claimed limitation as recited by independent claim 15. As for the rest of the limitations in independent claim 15 which are similar to the limitations in independent claim 1 and 28, appellant attention is directed to response to argument A.

- G. Appellant argues that Frank does not anticipate appellant's invention as recited in claims 1, 15 and 28. Therefore, dependents claims 2-14, 16-27 and 29-31 are also not anticipated by Frank (brief page 8 lines 1-3)

In response to G) Frank does anticipate claims 1, 15, 28, as outlined above and therefore dependents claims 2-14, 16-27 and 29-31 are subsequently anticipated by Frank.

In conclusion, the Examiner believes it is now clear how the claimed subject matter is anticipated by Frank and interpreted by the Examiner.

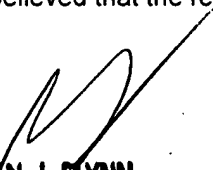
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**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,



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December 19, 2006



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